CHAPTER 9

RIGGING AND REEVING

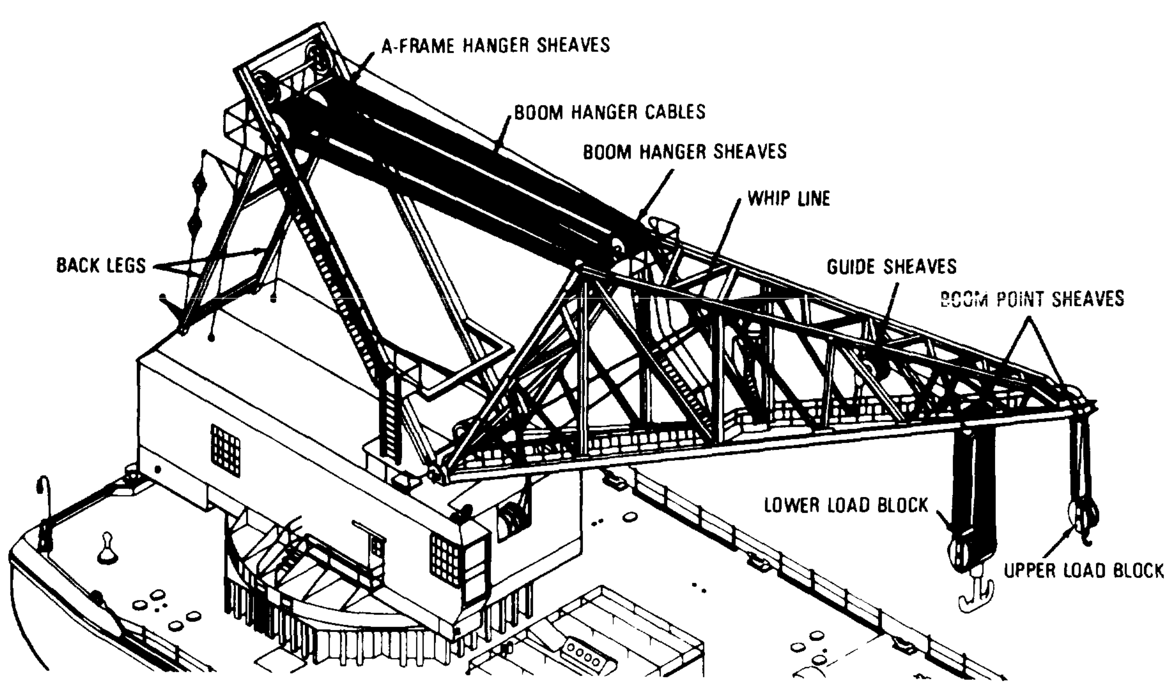
This chapter sets out the procedures for rigging and reeving on both the 60- and 100-ton floating cranes. It also covers the types and size wire used in rigging, as well as maintenance of the wire cable.

RIGGING

Crane rigging consists mainly of lines, sheaves, cables, and blocks. Included are load lines, A-frame hanger sheaves (pulleys), boom hanger sheaves, boom point sheaves, guide sheaves, boom hanger cables, whip block, upper load block, and lower load block. See the following illustration.

All blocks and the cables running from near the midsection of the boom to the top of the boom are known as the “topping lift.” This rigging supports the boom, With a series of cables and blocks, this rigging enables lowering or raising of the boom to increase or decrease the radius of its reach. The topping-lift cable is reeved with more parts than the load line, since the topping-lift cable must support the weight of both the boom and load.

Principle Parts of Crane Rigging



LOAD LINES

For the main or heavy-load hoist, a series of cables runs through sheaves from-the load block up to the peak of the boom and down to the main hoist drum in the machinery house. The size and number of cables vary with the lifting capacity of the crane.

For the auxiliary or whip hoist line, the series of cables runs through the sheaves from the light load hook to the sheaves at the tip of the boom and back to the auxiliary hoist drum. The size and number of these cables also vary with the lifting capacity of the light load hook.

BLOCKS

A block consists of a shell (frame) which supports the ends of a pin around which one or more grooved sheaves revolve. The pin serves as the axle for the sheaves. A hook, usually of the swivel type, is attached to one end of the block. Block sizes are determined by the length (in inches) of the shell and by the number of sheaves it contains. Blocks with one, two, three, and four sheaves are called single, double, triple, and quadruple blocks respectively. The largest wire rope that can be used on a block is determined by the diameter of the sheave, depth of the groove, and size of the opening through which the wire rope passes. The recommended size of line or cable on a block is the largest diameter possible that will fit the groove in the sheave and have clearance between pthe frame or shell and the sheave. The diameter of the sheave must be at least 20 times the diameter of the wire rope.

Grooves in sheaves should contact the sides of a wire rope up to almost one-half its circumference. When the groove is too large, the rope tends to flatten under tension. Use a groove gage to determine proper size rope to be used in the groove.

LIFTING POWER

The use of multiple sheave blocks increases the weight that can be lifted. This increase depends upon the number of sheaves in the sheave blocks and the number of rope parts between the blocks. However, the size and construction of wire rope, diameter of sheaves, score (uneven wear) on wire rope sheaves, size of sheave pins, and friction at the sheave pins are all factors that reduce lifting efficiency. The sum of all these factors increases with the number of sheaves and ranges from 10 to 40 percent.

The load on the hauling part of a one-part line is theoretically the same as the supported load, if friction loss and inefficiency factors are disregarded. However, friction is always present where ropes run over sheaves. The amount of friction increases proportionally with the number of parts or sheaves.

In a two-part line, the load on the hauling part is one-half the supported load plus friction. It is one-third for a three-part line, one-fourth for a four-part line, and one-fifth for a five-part line.

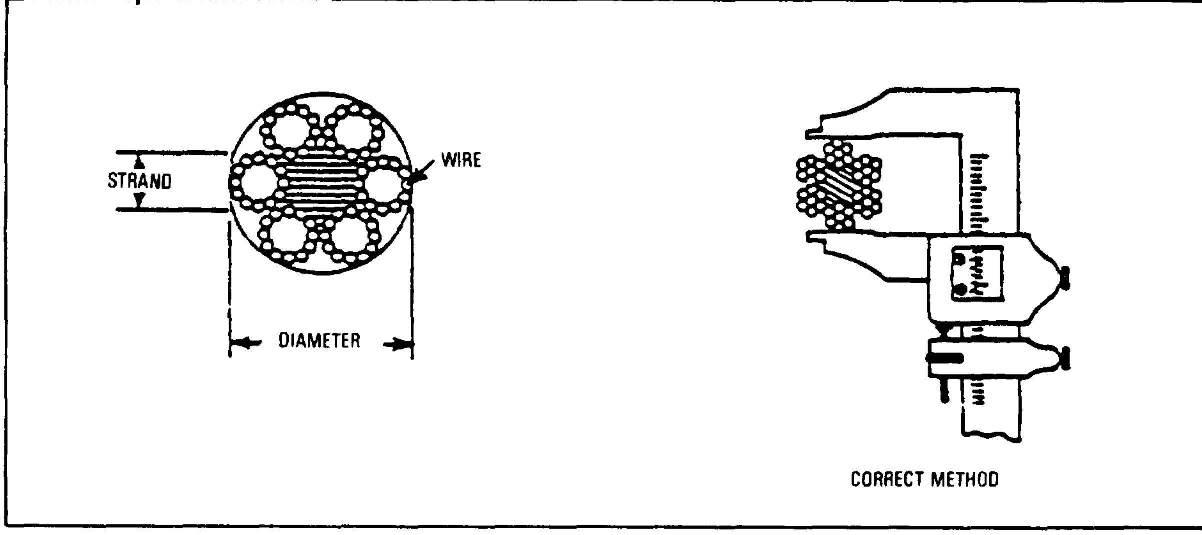
To estimate the lifting power gained through the use of multiple-sheave blocks, multiply the weight on the hauling part of the purchase by the number of parts of rope between the blocks and make deductions for inefficiency factors as done in the following example.

Calculate the weight that can be lifted with a power winch of 7,600-pound capacity, using a five-part line and a 3/4-inch wire rope. For this calculation, assume that the inefficiency of a five-part line is 25 percent and that the breaking or tensile strength of a 3/4-inch rope is 23.7 tons. The safe load for crane wires equals the safe load for one wire. Therefore, the breaking or tensile strength of a 3/4-inch wire rope (23.7) is divided by a safety factor of 5, which equals 4.74 tons, the safe load for one wire. The safe load for a five-part line should be 5 times 4.74 or 23.7 tons. The 25 percent reduction for inefficiency will reduce the safe working load of the tackle to 17.8 tons.

WIRE ROPE

The diameter of a wire rope is the diameter of the circle which will compactly enclose all of the strands. The diameter of a strand is the diameter of the circle which will enclose all of the wires in the strand. The correct diameter of a wire rope or strand is its greatest diameter and is measured from its outer extremities as shown in the following illustration.

Wire Rope Measurement



The wire rope used in crane operations is subjected to several kinds of stresses. The most frequently encountered stresses result from direct tension, acceleration, sudden or shock loads, bending, and the action of several forces at one time. For the most part, these stresses can be converted into terms of simple tension, and a rope of approximately the correct strength can be chosen. Since the strength of a wire rope depends on its size, grade, and construction, these three factors should be considered.

The safety factor of wire rope is the ratio of the strength of the rope to the working load. For example, a wire rope with a strength of 10,000 pounds and a total working load of 2,000 pounds would be operating with a safety factor of 5. However, it is not possible to set accurate safety factors for the various types of equipment using wire rope, since these will vary with conditions on the individual units of equipment. The proper safety factor depends on the—

- Loads to be lifted.
- Speed of operation.
- Type of fittings used for securing the rope ends.
- Acceleration and deceleration.
- Length of rope.
- Number, size, and location of sheaves and drums.
- Factors causing abrasion and corrosion.
- Facilities for inspection.
- Possible loss of life and property in case of failure.

Wire rope is designated by how it is manufactured, its circumference, the number of strands in the wire rope, and the number of wires in each strand. The more wires in a strand, the more flexible the wire rope. The wire rope recommended for the floating crane is improved plow steel wire rope, 6 x 37 (6 strands, 37 wires per strand), of varying circumference. The following table shows the recommended size of wire rope to use for the 60- and 100-ton crane.

Cable Dimensions (Improved plowsteel wire rope)

	CIRCUMFERENCE	CONSTRUCTION	LENGTH
60-ton crane:			
Luffing cable	1 1/8 inch	6 x 37	1,400 feet
Main hoist	1 1/8 inch	6 x 37	1,400 feet
Auxiliary hoist	7/8 inch	6 x 37	730 feet
100-ton crane:			
Luffing cable	1 1/4 inch	6 x 37	*1,984 feet
Main hoist	1 1/8 inch	6 x 37	2,530 feet
Auxiliary hoist	7/8 inch	6 x 37	1,100 feet

*Luffing cable is in two pieces: starboard wire is 1,004 feet long, port wire 980 feet long.

REEVING

METHODS

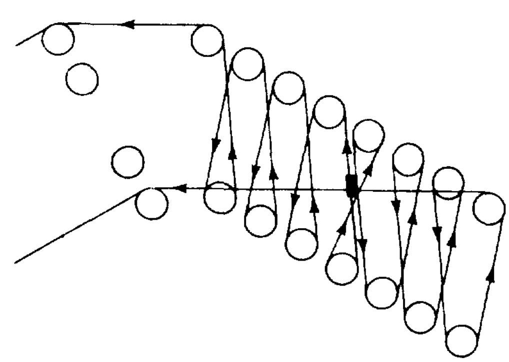
Two basic methods are used in reeving a floating crane. One method is to start the reeving operation from the fully wound drum. This method is used mostly on rotating-type cranes which have boom foot pins located at the top of the cab. Thus, when the boom is secured in its cradle, all parts of the boom are accessible. The cable is run directly from the hoist drum and reeved through its respective guide sheave blocks.

The second method is to begin the reeving process at the load end where the cable is threaded through the sheave blocks and the necessary fleeting sheaves before it is wrapped onto the respective hoist drums. This method is used on rotating cranes where the boom foot pins are located at considerable distance above deck and the boom resting in its cradle is too high to be reached from the deck. The reeving operation is started from the sheave blocks. The cable is unreeled from the supply reel, and the reeving operation is started by threading the cable through the load end of the sheave blocks. A stationary or swinging scaffold will have to be used for one person to work from, and the heavy cable will need to be lifted by a block and tackle of Manila rope.

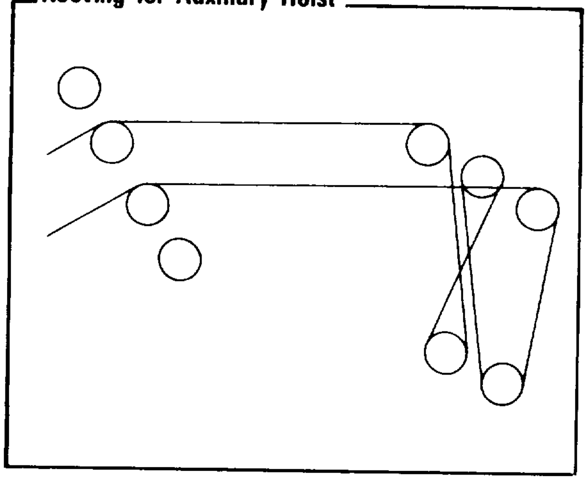
BLOCKS

Shown in the following illustrations are reeving diagrams for the main hoist, auxiliary hoist, and boom hoist (luffing) of the 100-ton crane.

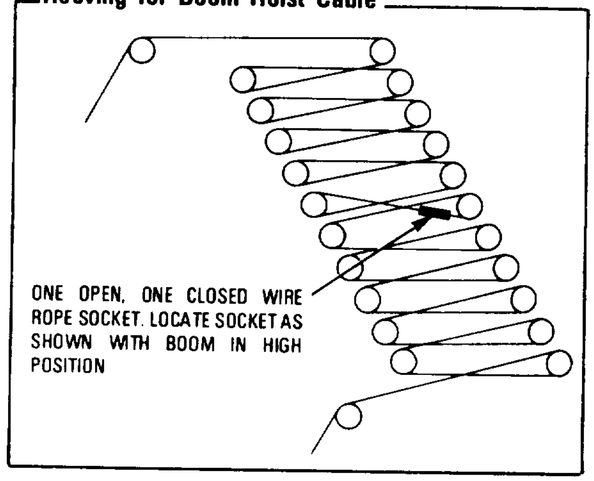
Reeving for Main Hoist



Reeving for Auxiliary Hoist

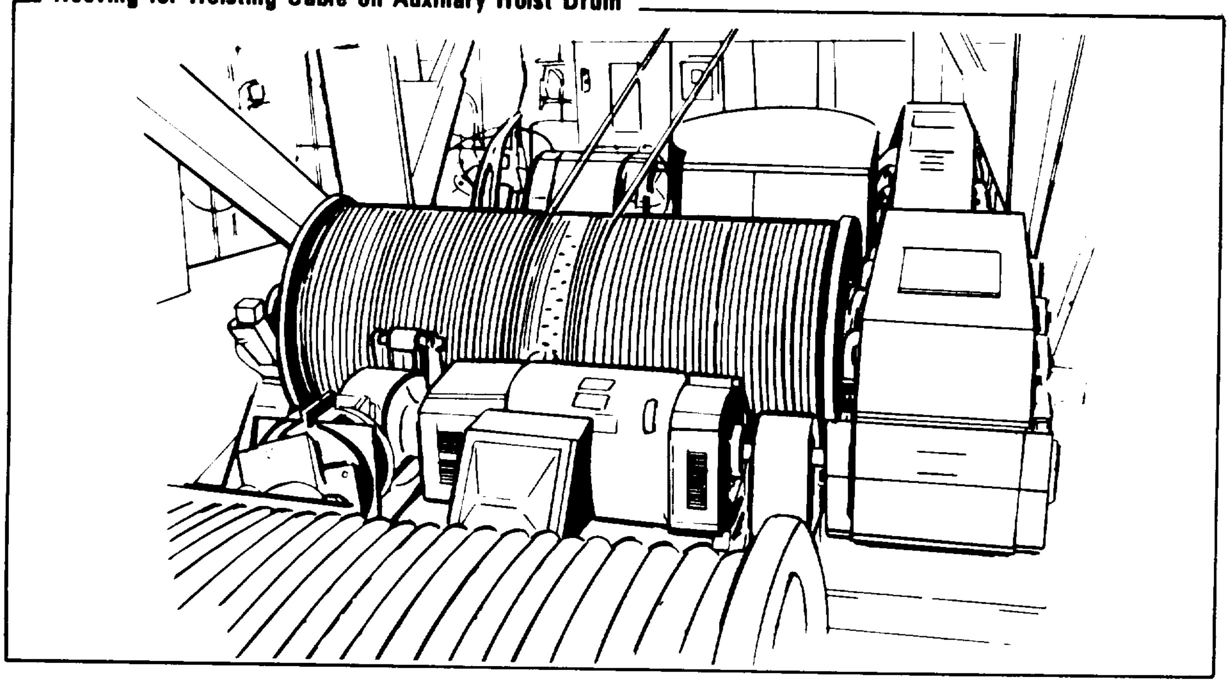


Reeving for Boom Hoist Cable



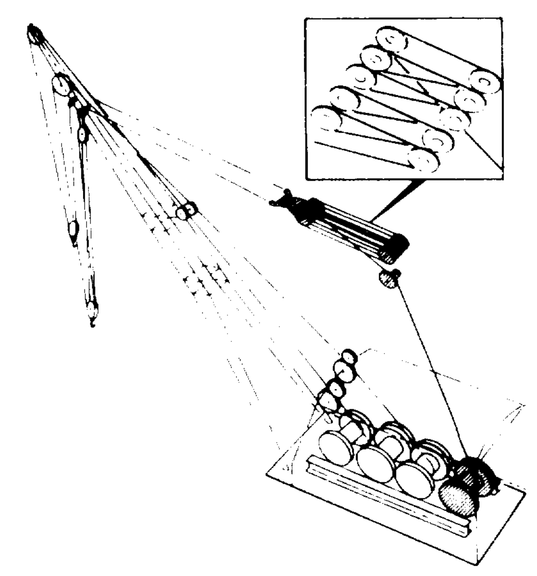
As seen in the diagrams, there are two bitter ends to the hoisting wire. These bitter ends are fair lead back to their hoist drum, reeved from the center of the drum, and wound outward to the respective outboard ends of the drum. The bitter ends are then made fast in the securing socket on the outside edge of the drum.

Reeving for Hoisting Cable on Auxillary Hoist Drum

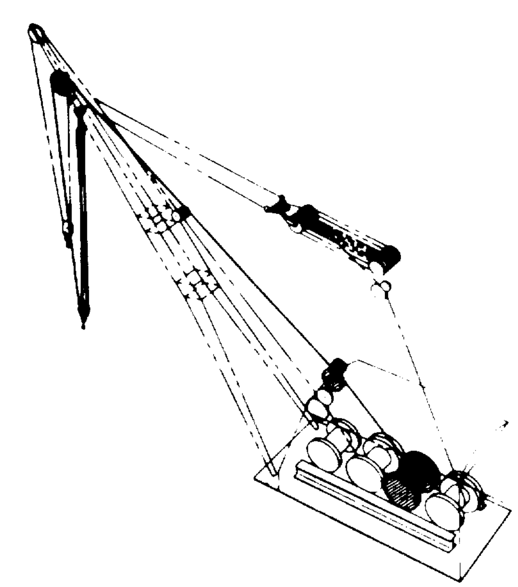


The following reeving diagram is for the boom hoist (luffing) cable on the 60-ton crane. The cable for hoisting the boom extends from the boom drum, through the top of the machinery house, through the boom line guide sheave located at the top of the A-frame, and around the boom hanger sheave arrangement which is attached to both the A-frame and the boom. Each time cable is run around a sheave, all the slack should be taken up. The dead end of the cable should be attached to the boom hanger sheave assembly and secured with a clamp.

Reeving of Boom Hoist Cable



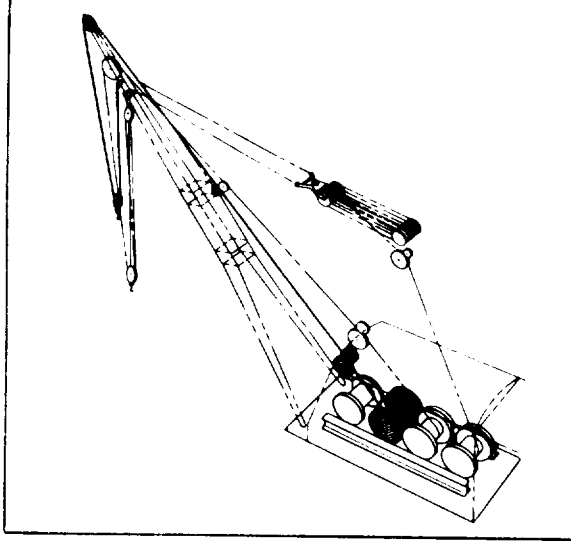
Reeving of Main Load Line



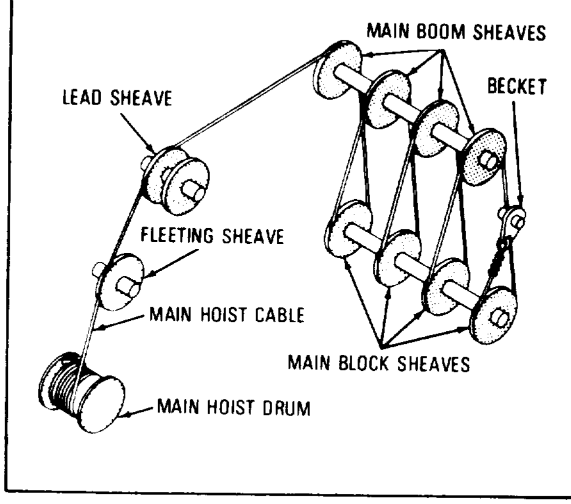
The procedures for reeving the main hoist cable on the 60-ton crane are shown in the following diagrams.

The main load line extends from the main load drum and through the machinery house opening, the bottom fleeting sheaves on the A-frame, the boom guide sheave, the inner boom point sheave, and the lower and upper load blocks. The dead end is attached to the boom.

Reeving of Whip Line

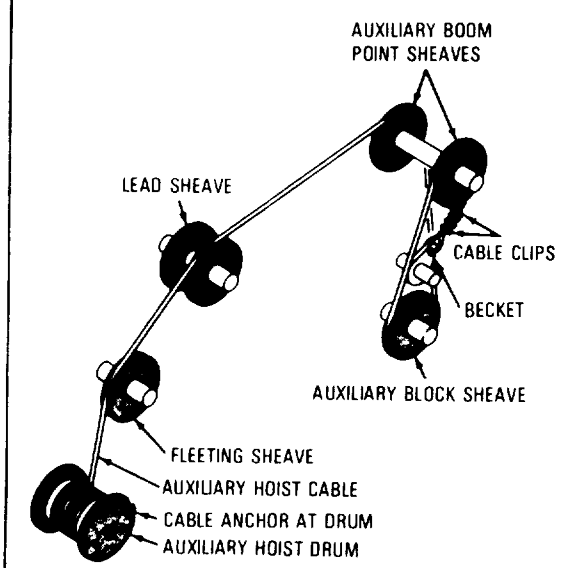


Reeving of Main Hoist Cable (Exploded view)

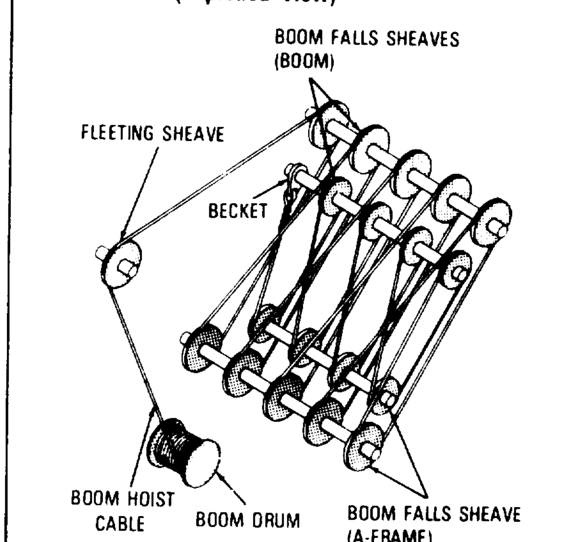


The following illustration is a reeving diagram of the auxiliary hoist cable on the 60-ton crane. The whip line extends from the whip drum through the machinery house, the whip-line fleeting sheaves, the boom guide sheave, the outer boom point sheave, and the whip block sheave. The dead end is attached to the boom point bail.

Reeving of Auxiliary Hoist Cable



Reeving of Boom Topping Hoist Cable (Exploded View)



MAINTENANCE

Wire rope should be visually inspected daily. Conditions that require special attention are kinks, flattening of the wire, strands bent out of shape, excessive dirt, or broken wires in a strand (fish hooks). Semiannually, the cable should be laid out and cleaned. The wire rope should be carefully cleaned so that new lubricant will adhere properly.

Spot-check different areas of the wire for damage, and measure the circumference of the wire rope to see if it has been stretched out. If after cleaning and inspection, the wire rope is satisfactory, lubricate (slush) it with Gulf Gulflex Moly or its equal. Lubricate all of the sheaves, blocks, and associated parts of the hoisting system. All lubrication should be done with a pressure gun using Gulf Oil Supreme Cup Grease 2 or its equal. The auxiliary hoist hood trunnion assembly should be brush- or smear-lubricated.